REMARKS

I. Status of the Application

Claims 17-20 are pending in this application. In the November 18, 2002 Office Action, the Examiner:

A. Rejected claim 17 under 35 U.S.C. § 102(e) as allegedly being anticipated by U.S. Patent No. 6,378,378 to Fisher;

B. Rejected claim 18 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Fisher in view of U.S. Patent No. 4,872,945 to Myers et al. (hereinafter "Myers"); and

C. Rejected claims 19-20 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Fisher in view of Myers and U.S. Patent No. 5,444,637 to Smesny et al. (hereinafter "Smesny").

In this response, Applicant has amended claim 17, 19 and 20 and added claims 21-27. Applicant has further canceled claim 18, without prejudice. Applicant respectfully traverses the foregoing rejections and respectfully requests allowance of all claims in view of the following remarks.

II. The Prior Art Rejection of Claim 17 Should be Withdrawn

In the Office Action (Paper No. 4) dated November 18, 2002, the Examiner rejected claim 17 under 35 U.S.C. Section 102(e) as allegedly being anticipated by Fisher. Applicant has amended claim 17 to incorporate all of the limitations of claim 18. Claim 18 does not

stand rejected as being anticipated by Fisher. Accordingly, it is respectfully submitted that the anticipation rejection of claim 17 is moot and should be withdrawn.

Claim 18 stands rejected as allegedly being obvious over Fisher in view of Myers. As will be discussed below, neither Fisher nor Myers, alone or in combination, disclose each and every element of claim 18 (and thus claim 17, as amended). Accordingly, it is respectfully submitted that claim 17 is patentable over the prior art.

A. The Present Invention

Claim 17 is directed to a method of fabricating a semiconductor wafer, including subjecting the semiconductor wafer to a pressure. The pressure the semiconductor wafer is subjected to is measured with a pressure measurement device supported on the semiconductor wafer. The amendments to claim 17 recite that the pressure measurement device includes (i) a capacitor, (ii) capacitance measurement circuitry electrically coupled to the capacitor, and (iii) capacitance to pressure conversion circuitry electrically coupled to the capacitance measurement circuitry. The amendments to claim 17 further recite that the measuring step includes converting a capacitance of the capacitor to a pressure with the capacitance to pressure conversion circuitry.

B. Fisher

Fisher is directed to a device and a method for measuring the pressure across the surface of a test wafer during simulated processing conditions. The simulated process may be, for example, a chemical vapor deposition process or an etch process. In an exemplary

embodiment, a plurality of micro-electro-mechanical systems pressure sensors are arranged across the surface of a test wafer. The pressure sensors are attached to wires that *lead outside of a processing chamber*. Electrical signals from the pressure sensors are measured under simulated wafer processing conditions to determine the pressure at the various pressure sensors. Processing parameters, such as nominal chamber pressure, gas flow rates, exhaust rates, and wafer position may be varied to determine the effect these parameters have on the pressure present at the surface of the wafer (column 1, line 66 through column 2, line 13).

C. Myers

Myers is directed to a process for manufacturing a pressure transducer of a pressure sensor. Initially, a capacitive pressure transducer is formed by bonding a silicon diaphragm to a glass base such that the transducer produces different capacitances in response to different diaphragm deflections provided in response to sensed pressures. The sensitivity of the capacitive pressure transducer is adjusted by etching the silicon diaphragm while it is bonded to the base substrate in accordance with capacitance values of the transducer which were previously obtained at various predetermined pressures. In this manner, the thickness of the silicon diaphragm is selectively reduced to obtain an accurate desired sensitivity for the transducer and handling of very thin silicon diaphragms prior to their assembly to associated transducer bases is eliminated.

D. Fisher Does Not Teach or Suggest a Pressure Measurement Device Supported on the Semiconductor Wafer that Includes Capacitance to Pressure Conversion Circuitry

Fisher does not disclose multiple elements of claim 17, as amended. In particular, Fisher does not disclose use of a pressure measurement device that is supported on the semiconductor and *which includes capacitance to pressure conversion circuitry*. Moreover, Fisher does not disclose the associated step of *using* that capacitance to pressure conversion circuitry.

1. Fisher Appears to Vaguely Teach Use of Capacitive Sensors

In the November 18, 2002 office action, the Examiner stated that Fisher does not disclose a capacitive sensor. (Office Action at p.3). Applicant, however, would like to direct the Examiner's attention to column 3, lines 21-27. "A number of pressure sensors 12 have been attached to a surface 14 of the wafer with epoxy adhesive 16. . . . The sensors could be a variety of sensors, such as capacitive MEMS pressure sensors, piezoresistive MEMS pressure sensors or other types. . . ."

2. Fishers Does Not Teach Conversion Circuitry Supported On-Chip

Applicant nevertheless respectfully submits that regardless of whether capacitive sensors are taught by Fisher, neither Fisher nor Myers teach the inclusion or use of capacitance to pressure conversion circuitry that is *supported on the semiconductor*.

More specifically, while Fisher teaches the use of *sensors* supported on the semiconductor, the sensors in Fisher provide sensor signals to an *external* measurement unit 112 (Fisher at col. 2, lines 7-9). To the extent that Fisher would include any capacitance to pressure conversion circuitry, such circuitry would be located in the external measurement

unit 112, and thus could not be supported on the semiconductor.

In particular, Fig. 7 of Fisher illustrates that the measurement unit 112 is clearly located outside of the chamber and therefore cannot be *supported on the semiconductor*. Furthermore, the capacitance to pressure conversion circuitry, if any, would only be located within the measurement unit 112 and not within the sensor devices 12 on the semiconductor. To this end, the sensor devices of Fisher provide only raw output signals, not pressure measurement signals. Specifically, the following passages illustrate the nature of the signals that are generated by the sensor devices of Fisher:

> A first static pressure is established and maintained (step 804) in the chamber. There is no appreciable gas flow into or out of the chamber while the *output signals of the pressure sensors are measured and stored* (step 806). A second static pressure is established and maintained (step 808) in the chamber, *and the output signals of the pressure sensors are measured and stored* (step 810).

(Fisher at col. 9, lines 33-39)(emphasis added).

> *The output signals from the sensors are measured* (step 906) and compared against the calibration data for the Respective sensors (step 908).

(*Id.* at col. 9, lines 49-52)(emphasis added).

It is noted that the above passages repeatedly state that the "output signals" of the sensor devices of Fisher are subsequently "measured". It is clear that the output signals of the sensor devices require "measurement" and thus cannot constitute final pressure measurement values. Instead, the output signals are clearly raw sensor signals that must be converted to useful pressure information. As a consequence, the sensor devices of Fisher, which are the only devices supported on the semiconductor in Fisher, do *not* include, among other things, capacitance to pressure conversion circuitry.

For the foregoing reason, Fisher does not include a step of measuring pressure with a

pressure measurement device, the pressure measurement device including, among other things, capacitance to pressure conversion circuitry, as called for in claim 17. Fisher also does not include a step of converting a capacitance to a pressure using that conversion circuitry, as also called for in claim 17.

E. Myers Does Not Teach or Suggest a Pressure Measurement Device Supported on the Semiconductor Wafer that Includes Capacitance to Pressure Conversion Circuitry

The Examiner does not appear to allege that Myers teaches or discloses use of a pressure measurement device supported on a semiconductor wafer that includes capacitance to pressure conversion circuitry. Moreover, as shown in Fig. 1, Myers does not appear to disclose use of a pressure measurement device, supported on a semiconductor, which includes capacitance to pressure conversion circuitry.

F. Claim 17 is Allowable

For all of the above reasons, Applicant respectfully submit that neither Fisher nor Myers, either alone or in combination, disclose or suggest the use of a pressure measurement device supported on a semiconductor that includes capacitance to pressure conversion circuitry. Accordingly, no combination of these references arrives at the invention of claim 17, as amended. As a consequence, Applicant submits that claim 17 is in condition for allowance, which is hereby respectfully requested.

IV. The Prior Art Rejection of Claims 19 and 20 Should be Withdrawn

In the Office Action, the Examiner rejected claims 19 and 20 under 35 U.S.C. Section 103(a) as allegedly being unpatentable over Fisher in view of Myers and Smesny. It is respectfully submitted that the combination of Fisher, Myers and Smesny as proposed by the Examiner in the November 18, 2002 office action does not arrive at the invention.

In particular, in the November 18, 2002 office action, the Examiner alleged that:

> It would have been obvious to one of ordinary skill in the art at the time of the invention to take the pressure data, store it, and transmit it to a relevant control center, since this would allow calibration of the processing conditions of a process like that of Fisher.

(Office Action at p.3). Even if Fisher were modified, as proposed by the Examiner, "to take pressure data, store it, and transmit it to a relevant control center", such modification would not teach inclusion of capacitance to pressure conversion circuitry that is supported on the semiconductor, as called for in claim 17.

Specifically, Fisher and Meyers implement all of their conversion and measurement circuitry in a manner that is *not* supported by the semiconductor. The Examiner does *not* allege that any motivation or suggestion exists to modify Fisher and Meyers to use conversion and measurement circuitry that is supported on the semiconductor.

Thus, claim 17 is allowable over the proposed combination of Fisher, Meyers and Smesny. Because claims 19 and 20 depend from and incorporate all of the limitations of claim 17, claims 19 and 20 are patentable over the proposed combination of Fisher, Meyers and Smesny for at least the same reasons.

Moreover, it is respectfully submitted that the Examiner has mischaracterized Smesny. In particular, the Examiner alleged that Smesny contains the teaching of a transmitter circuitry that is coupled to "capacitance conversion circuitry". (Office Action at p.3). Smesny does not disclose the use of capacitors used as sensors, much less capacitance conversion circuitry. Accordingly, it is respectfully submitted that claims 17, 19 and 20 are patentable over the proposed combination of Fisher, Meyers and Smesny for at least the same reasons.

Finally, there is no motivation or suggestion to use on-chip processing elements, as taught by Smesny, in the Fisher system. Fisher specifically employs *external* processing to facilitate obtaining "real time" values external to the chamber. (Fisher at col. 3, lines 7-16). Obtaining real time values external to the chamber would allow for sophisticated processing of sensed values from various areas of the semiconductor. Presumably, an operator may observe real-time results and change conditions in the chamber to determine the effects on the pressure. To this end, Fisher describes a relatively powerful computer-based external measurement unit (Col. 7, lines 30-40). By contrast, the on-chip processing devices taught by Smesny do not appear to be able to provide real-time values. Indeed, Smesny does not disclose whether or how information may be passed in real time (in chamber) to a device external the chamber.

As a consequence, one of ordinary skill in the art would not be motivated to modify Fisher to incorporate the on-chip processing devices of Smesny because the on-chip processing devices of Smesny are not configured for provide real time values external to the chamber. Accordingly, it is respectfully submitted that claims 17, 19 and 20 are patentable over the proposed combination of Fisher, Meyers and Smesny for at least the same reasons.

V. Newly Added Claims 21-26 Are Allowable

Claims 21-26 have been added herein to alternatively define the present invention. Claims 21-26 depend from, either directly or indirectly, from claim 17. Accordingly, for at least the same reasons as those set forth above in connection with claim 17, it is respectfully submitted that claims 21-26 are allowable over the prior art.

VI. Newly Added Claims 27 and 28 are Allowable

Newly added claim 27 is similar to claim 17, except that it includes an additional step of forming the capacitor sensor on the semiconductor wafer, and does not recite the capacitance measurement circuitry or the capacitance to pressure conversion circuitry as being part of the device that is supported on the substrate.

It is submitted that Fisher does not disclose the step of forming the capacitor sensor on the semiconductor wafer as claimed in claim 27. Moreover, none of the cited art teach such a step. For the reasons given above, Applicant submits that claims 27-28 are in condition for allowance, which is hereby respectfully requested.

VII. Conclusion

It is respectfully submitted that all claims are in condition for allowance. Accordingly, prompt and favorable examination is earnestly solicited.

Respectfully Submitted,

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APPENDIX

Pursuant to 37 C.F.R. Section 1.121(c)(1)(ii), below are the changes to claims 17, 19-20.

17. (amended) A method of fabricating a semiconductor wafer, comprising:

(a) subjecting said semiconductor wafer to a pressure; and

(b) measuring said pressure said semiconductor is subjected to with a pressure measurement device supported on said semiconductor wafer, said pressure measurement device including (i) a capacitor, (ii) capacitance measurement circuitry electrically coupled to said capacitor, and (iii) capacitance to pressure conversion circuitry electrically coupled to said capacitance measurement icruity, and further including converting a capacitance of said capacitor to a pressure with said capacitance to pressure conversion circuitry.

19. (amended) The method of claim 17, wherein said pressure measurement device includes capacitance to pressure conversion circuitry, said method further comprising:

(c) storing said pressure in pressure data storage circuitry supported on said semiconductor wafer, said pressure data storage circuitry being electrically coupled to said capacitance to pressure conversion circuitry.

20. (amended) The method of claim 17, wherein said pressure measurement device includes capacitance to pressure conversion circuitry, said method further comprising:

[(d)] (c) transmitting a signal indicative of said pressure to a receiver with transmitter circuitry which is (i) electrically coupled to said capacitance to pressure conversion circuitry

and (ii) supported on said semiconductor wafer.